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GHG emission trading implications on energy sector in Baltic States

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Abstract

The article deals with the issues related to the implementation of EU greenhouse gas (GHG) emission trading scheme in Baltic States. The main objectives of the article are to analyse the main features and requirements of EU emission trading scheme and to assess the results of the first trading GHG trading period based on verified GHG emissions in Baltic States. The main aim of the article is to compare GHG emission trading results among Baltic States and provide with some insights for the next GHG trading period and assess possible implications on energy sector of Lithuania, Latvia and Estonia.

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Keywords: GHG emission trading; Energy sector

Contents

1. Introduction

The aim of EU emission trading scheme (EU ETS) is to help member states to fulfil their Kyoto commitments at lowest costs. EU ETS has been implemented in January 2005. The prime purpose in using an emission trading system for climate policy is cost-efficiency, i.e. to achieve a given emission target at minimum cost [17]. The costs to reduce emissions will eventually be reflected in the market price for EU emission allowances (EUAs) and induce demand for innovative, energy/carbon saving processes, products and services. This increased demand should in turn lead to more research and development (R&D), and the invention, adoption and market diffusion of such innovations (dynamic efficiency). In contrast to other environmental instruments, emission trading systems also assure that a particular environmental target is met. Since the quantity of allowances allocated (emissions budget or cap) corresponds to the emission target for a particular period, the number of greenhouse gases (GHGs) emitted may not be higher than the number of allowances allocated. For these reasons, emission trading systems are often considered to be superior to other regulations [14].

The EU ETS scheme covers some 11,500 industrial plants and about 45% of the CO_2 emissions in the EU25. In addition to energy installations above 20 MW also facilities of the metal, mineral and forest industry are included in the scheme. Member states will allocate annually emission allowances that can be freely traded on the market, to the companies included in the

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EU ETS. Each year companies have to surrender equal number of emission allowances to their previous years CO_2 emissions to the authorities [10]. The new trading period on 1 January 2008 have already started and will last until 2012. The results of GHG emission trading in the first phase 2005–2007 should be reviewed seeking to identify the impact on energy sector and to define the main challenges arising for next trading period for Baltic States. EU member states must make their first issuance of allowances to EU ETS installations under their second period allocation plans by 28 February 2008. Poland, Czech Republic, Estonia, Hungary Latvia, Lithuania and Slovakia have announced legal challenges against the EC due to reduced allocations. The European Commission reduced requested amount of allowances for Latvia by 57%, for Lithuania by 47% and for Estonia by 47.8%. Such strict caps for Baltic States can have negative impact on Baltic States energy sector.

The aim of the article is to analyse the results of the first phase of EU GHG emission trading and the main implications for energy sector of Baltic States. The main tasks to achieve this goal:

- Short overview of EU GHG emission trading scheme.
- Analysis of GHG emission trends in Baltic States.
- Analysis of GHG emission allowance price development in 2005–2007.
- Comparison of GHG emission trading first phase results in Baltic States.
- Discussion of the challenges of 2008–2012 trading period for energy sector of Baltic States.

2. EU GHG emission trading scheme

The EU adopted a Directive (2003/87/EC) introducing a scheme for GHG emission allowance trading within the Community. Emissions trading (ET) in some sectors have started in 2005; the first 3-year trading period is limited only to CO_2. The scheme is supposed to cover about 46% of the EU-15's total CO_2 emissions in 2010 [8]. The Directive is a key element of the Community's climate change policy and its objective is to promote reductions of greenhouse gas emissions in a cost-effective and economically efficient manner. It is therefore important to ensure that the emissions trading scheme has a positive environmental outcome. The national allocation plans are the means to achieve this goal.

The Directive 2003/87/EC defines the participants, gasses and sources of GHG emissions that are covered by the scheme. During the first period only CO_2 emissions will be covered from electricity and heat production, fuel combustion installations over 20 MW, and major industrial sectors (iron and steel, oil reefing, glass and ceramics, cement, paper and pulp production. All above-mentioned emitters account for 46% of total European CO_2 emissions. The other industry sectors and gases will be covered by the scheme during the following trading periods. Directive requires every emitting installation to have a permit to emit CO_2 from 1 January 2005. The EU trading scheme foresees emission caps for all power and energy intensive industry sectors within EU member states. Allowances will be allocated for every individual installations based on allocation formulas. Companies will be free to choose either to use the compliance or trade. The emissions from each installation will be required to match the allowances allocated. CO_2 allowances have a value mainly due to the very simple fact that every installation where GHG emissions exceed allowances will need to invest in measures reducing the emissions or to buy allowances on the market. Installations, which reduced emissions below their allowances will have three possibilities: to increase emissions, to sell allowances to another installations across EU or to bank saved allowances for next year. There are no limitations of CO_2 emissions for individual installations only installation has to have allowances. If installation does not have enough allowances it can buy them from another market participant that has a surplus of allowances because has already reduced its emissions (Streimikiene, Bubniene, 2004).

The penalty of 40 EUR/tCO_2 is foreseen for the first trading period and 100 EUR/tCO_2 is foreseen for the second trading period. Member states can introduce additional penalties in their national legislation. A total 11,428 installations have been reported by member states and 6572.4 billion tones of CO_2 emission permits were distributed among member states (Table 1) [6].

As one can see from Table 1 the GHG emissions of old member states in 2003 exceeded the requirements of Kyoto protocol by 272 Mt of CO_2 equivalent. Even taking into account the planned to acquire GHG emission credits form application of Kyoto flexible mechanisms old member states need to decrease GHG emissions by 131 Mt. Therefore, for old EU member states GHG emission trading can be an attractive opportunity to reduce GHG emissions comparing with more expensive measures available for non-trading sectors (transport, agriculture, households, etc.). However, new EU member states have surplus of GHG emission credits by 282 Mt and are potential CO_2 emission allowance sellers in the first trading period.

Due to the surplus of the allowances in the EU new member states it was likely that there will be a surplus of allowances in the EU ETS. This precondition implies the low price of allowances and the little liquidity of the market in the end of trading period especially. The surplus of the allowances and windfall profit of the electricity producers decrease effectiveness of the system. Although following the theory, the price of the allowance shall be equal to the marginal emission reduction costs, in practice the marginal costs will be lower than the price of the allowances due to the surplus of the allowances [9].

GHG emission allocation surplus was also in Baltic States. The detailed results of the first GHG emission trading scheme will be analysed in the following chapters. However, the GHG emission trends should be firstly investigated in Baltic States.

3. Short overview of GHG emission trends in Baltic States

The Baltic States – Estonia, Latvia and Lithuania – each signed the UNFCCC in 1992 and ratified it in 1995. They also signed the Kyoto protocol in 1998 and ratified it in 2002. In

Table 1
Installations covered by EU ETS, CO_2 emissions allowances distributed in member states, base year GHG emissions and distance to the Kyoto in 2003

	Installations	Allowances distributed (Mt)	Kyoto commitments (%)	Emissions in 1990 (Mt)	Distance to the Kyoto in 2003 (%)
EU-15					
Austria	205	32.9	−13	288.965	25
Belgium	363	63.3	−8	113.405	8
Denmark	362	33.5	−21	52.100	26
Finland	500	45.0	0	53.900	18
France	1.500	156.0	0	366.536	−2
Germany	2.419	495.0	−21	1.012.443	3
Greece	141	74.4	25	82.100	−1
Ireland	143	22.3	13	30.719	10
Italy	1.240	232.5	−7	428.941	16
Luxemburg	19	3.3	−28	11.343	19
Netherlands	170	76.0	−6	167.600	7
Portugal	239	39.0	27	42.148	7
Spain	927	174.5	15	260.654	18
Sweden	499	22.9	4	61.256	−7
UK	1.078	245.3	−13	584.078	−1
New member sates					
Cyprus	13	5.6	–	1	–
Czech Republic	486	97.6	−8	169.514	−22
Estonia	43	21.6	−8	37.797	−87
Hungary	261	31.2	−8	71.673	25
Latvia	96	4.0	−8	22.976	−122
Lithuania	93	12.2	−8	54.350	−172
Malta	2	2.9	–	2	–
Poland	1.166	239.0	−6	414.930	1
Slovak Republic	300	35.6	−8	58.278	1
Slovenia	78	8.7	−8	–	1

accordance with the Kyoto protocol, signatories should, by 2008–2012, reduce the level of their aggregate anthropogenic GHG emissions to 8% below 1990 levels. Current GHG emissions in the Baltic States vary, but are all significantly below the Kyoto target. As the fuel combustion sector is responsible for 75–86% of total GHG emissions, a reduction of emissions in this sector will have the greatest impact on lowering emissions. GHG from electricity and heat sector in Estonia make 87% of total GHG emissions (in Lithuania, 29%; in Latvia, 23%) [1].

Development of Lithuanian GHG emissions from 1990 to 2005, Kyoto target and forecasted GHG emissions according ‘‘with measures’’ scenario in 2020 are presented in Fig. 1.

As one can see from Fig. 1 projections of GHG emission in Lithuania according scenario ‘‘with measures’’ will not exceed Kyoto target set for 2008–2012 as well as European Union obligations taken for 2020 to reduce GHG emissions by 20% comparing with base year level.

Development of GHG emissions in Latvia and GHG emissions projections according ‘‘with measures’’ scenario as well as Kyoto target for Latvia are presented in Fig. 2.

As one can see from Fig. 2 there is no evident problems for Latvia in implementing Kyoto target as well as EU GHG emission reduction target set for 2020.

GHG emission development in Estonia, GHG emission projections according ‘‘with measures’’ scenario and GHG

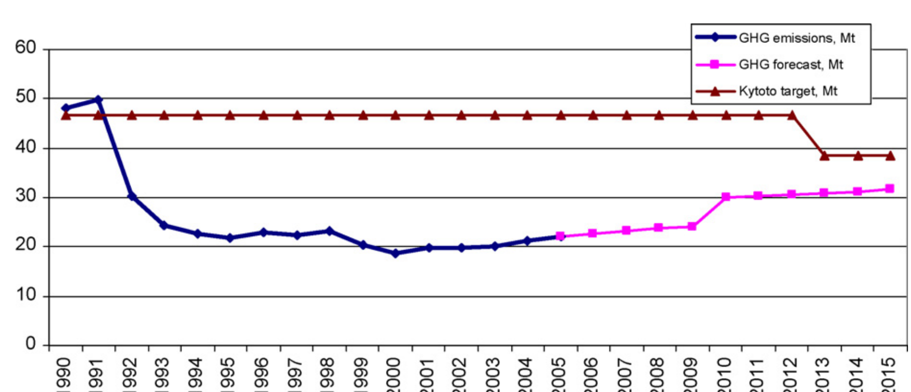

Fig. 1. GHG emission development and GHG emission projections according ‘‘with measures’’ scenario in Lithuania.

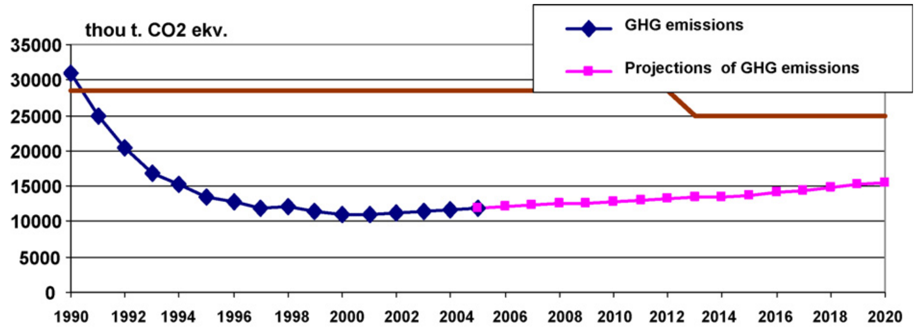

Fig. 2. GHG emission development and GHG emission projections according ‘‘with measures’’ scenario in Latvia.

emission limits set by Kyoto protocol for Estonia are presented in Fig. 3.

As one can see from Fig. 3 forecasted GHG emission in Estonia will not exceed Kyoto target and limits for 2020 set by EU GHG emission commitments.

Analysis of GHG emission trends in Baltic States indicated that GHG emissions have reduced significantly since 1990 in Baltic States and they do have problems with implementation of Kyoto targets. The biggest decrease in greenhouse gas emissions can be noticed in Lithuania as in 2005 greenhouse gas emissions in Lithuania were lower than in Estonia though in base year the situation was opposite. This is related with operation of Ignalina NPP which was the main power generation source in Lithuania and the biggest power plant in Lithuania was used mainly as reserve since 1993 then the fossil fuel prices were sharply increased for Baltic States. Therefore, Baltic States seem easily manage to achieve their Kyoto-targets for 2008–2012 without further efforts.

4. GHG emission price development in 2005–2007

Trading within EU ETS has taken off rapidly. The first trades with EU emission allowances were done already in early 2003 and trading volumes rose to significant levels as the year progressed. In January 2005, when the scheme officially started, the price-level was €8.3 per allowance (ton of CO_2) and dropped over the following weeks to under €7. At the end of January prices started to climb steadily and this increase accelerated in February. The bullish market continued until early July when the prices peaked at their all time highest €30.00. In the end of 2007 the allowances were traded at €0.2. The main price drivers are currently other energy commodities such as electricity and fuel markets as well as the weather patterns. In addition, the interest on the buying side seems to be higher than on the selling side. Eastern European companies that are expected to be net sellers of allowances have entered the market quite slowly, partly due to delays of the emission allowance registry system in some of the countries. The development of EU emission allowance price is presented in Fig. 4.

During the first part of the year 2005 the price for one emission right rose from about seven (7) euros to thirty (30). Reasons for this rapid price-hike and volatile price movements have been sought from fuel markets, economic trends, weather conditions and the situation in the new EU member states. The European Union Allowance (EUA) price is set by supply and demand. The supply is determined by the allowances and carbon credits available to the market: EUAs, Certified

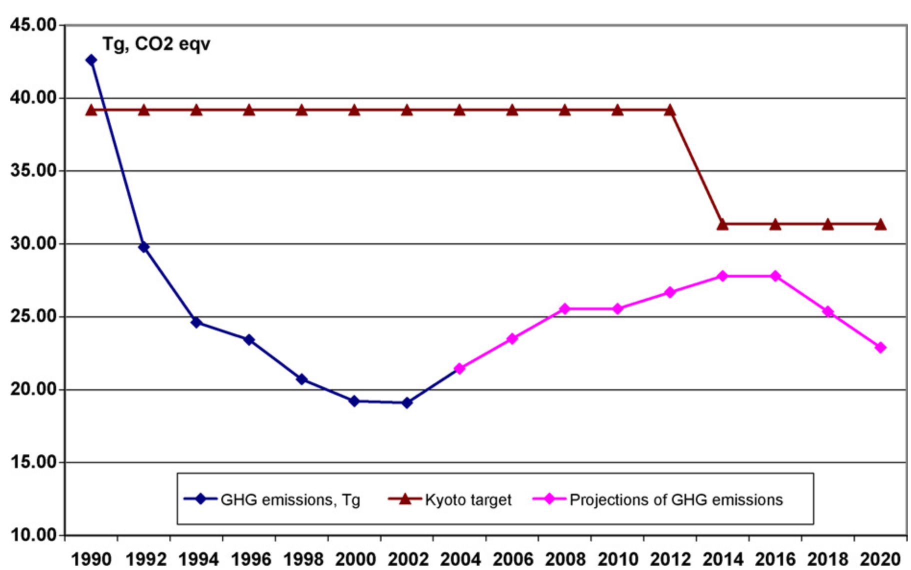

Fig. 3. GHG emission development and GHG emission projections according ‘‘with measures’’ scenario in Estonia.

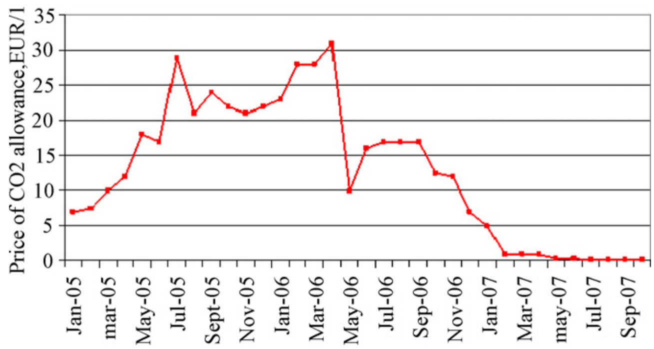

Fig. 4. EUA price development in the first trading period.

emission reduction units (CERs) and Emission reduction units (ERUs). Demand is set by the amount of emissions through the year in relation to the overall allocation. The demand is influenced by a weather (as temperature determines power/heat demand and precipitation the potential for hydropower production) and fuel prices (as the relative price differential between coal and gas will determine which of the fuels that will be used for power production). Relatively cheaper coal compared to gas will increase GHG emissions as more power production will be based on coal which emits more GHGs per unit of output than gas. Higher CO_2 emissions will increase the carbon price. The correlation between the EUA price and the combined effect from fuel and weather was 0.41 over the year 2006 as a whole, while in 2005 it was 0.92. The correlation between the price and weather and fuel for the entire year is relatively low due to the price crash in April/May, which obviously was not due to dramatically changes in fuel prices or weather, but rather the political publication of verified emission data [7].

The maximum percentage of CERs/ERUs that can be used in the trading period 2008–2012 stands at 13.6% of the amount of allowances to be allocated. For the 22 National allocation plans (NAPs) on which the Commission has decided this means around 258 Mt CO_2 per annum that can enter the EU ETS in the form of CERs and/or ERUs.

In practice the situation is much more complicated and there is no single reason for GHG emission market collapse in 2005–2007. The fuel prices impact the prices of emission allowances. When gas gets cheaper in relation to coal, the use of gas gets more profitable. This in turn lowers the emissions from power production, reduces the need for emission allowances and therefore brings the price down. The fluctuations in allowance prices cannot be explained by changes in fuel prices alone. Some temporary correlation can be found, but it is hard to say whether emission allowance prices follow fuel prices or whether it is the other way around.

A correlation can be found between electricity and emission allowance prices. This is natural as a company that produces electricity has to cover its emissions with emission allowances [9]. This increases the production costs. Emission allowances have in fact become one of the major factors, besides the water level in the Northern reservoirs, which influence electricity prices in the Nordic market. The price of emission allowances are naturally also dependent on how emissions develop in Europe. The extreme weather conditions have been sought as one reason for the price development. However, one has to be very careful with regard to this issue. For example a heat wave in Southern Europe can easily be compensated by a good water level in Northern Europe.

In addition the GHG emission market has been opened gradually. The first ones that became active were Northern and Western European energy companies and in a smaller scale energy intensive industry and the Southern European energy companies. The seller companies in the new member states have not yet begun selling up to their full potential, which has created an imbalance between supply and demand. This has increased the prices in the past. Another factor that is most probably affecting the price is that the most active companies come from sectors in which the price of emission allowances can easily be transferred to the price of their own products. For such companies, a high price is not as big a problem as for companies that due to fierce international competition cannot pass on the price of emission allowances to the price of their products.

Also changes in national allocation plans and schedules in implementation of national registries have caused rapid price fluctuations. Changes made in the middle of the trading period make it much more difficult for companies to operate on the market. Some of the costs on the market are, e.g. a direct result of the challenges some new member states have had in starting up emissions trading. In order for the market to be reliable and predictable it is imperative that the rules and regulations of the market are not changed during the trading period or even close to its beginning.

As we can see, the price development is clearly a sum of many not so easily predictable factors and companies have a difficult time getting a clear and reliable picture without the help of experts. In addition to the market fundamentals, the most difficult thing to predict is the actions on the authorities' side. In the future the price will also be affected by the possible linkage of the EU ETS to other emissions trading schemes as well as by the price of emission reduction credits that come from outside the EU.

5. Results of GHG emissions trading in 2005–2007 in Baltic States

Baltic States prepared National allocation plans according requirements of Directive 2003/87/EC and started greenhouse gas emission trading in 2005.

Comparing greenhouse gas emission data in base year, Kyoto targets, greenhouse gas emission in 2001 and allocated caps one can notice that in the first trading period the highest allocated amount of tradable allowances is defined in Estonian national allocation plan though greenhouse gas emissions in Lithuania were higher in 1990 and 2001 years, respectively (Table 2) [1].

This is related with high greenhouse gas emission share being attributed to energy sector of Estonia, especially for energy transformation sector. Such differences in total allocated amount and in Kyoto targets and current emission levels among

Table 2
Difference between annual average 2005–2007 GHG emission cap and verified GHG emissions in 2005–20076 in Baltic States

	Difference between annual average 2005–2007 allocation and 2005 verified emissions (Mt)	Difference between annual average 2005–2007 allocation and 2006 verified emissions (Mt)	% difference between annual average 2005–2007 allocation and 2005 verified emissions	% difference between annual average 2005–2007 allocation and 2006 verified emissions
Estonia	6.38	6.89	33.58	36.27
Lithuania	5.70	5.78	46.31	47.02
Latvia	1.75	1.73	37.95	37.58

Lithuania and Estonia can be explained that the biggest share in emission trading sector is taken by energy generating enterprises and as this sector is the major greenhouse gas emission contributor in Estonia total allocated amount of tradable permits in Estonia exceeds Lithuanian's ones. Greenhouse gas emissions from electricity and heat generation sector in Estonia in 1990 and 2001 amounted to 69% and 87% of total greenhouse gas emissions, respectively. At the same time greenhouse gas emissions from this sector in Lithuania in 1990 and 2001 amounted to 30% and 29%, respectively. In Latvia emissions from energy generation in 1990 and 2001 amounted to 34% and 23%, respectively therefore, the total allocated amount of tradable permits is about 5 times lower than in Estonia though total greenhouse gas emissions in 1990 were only by 1.5 times lower than in Estonia.

The Baltic States have very different energy and power supply sectors. Estonia distinguishes with the highest energy intensity of economy, highest energy consumption per capita levels and the most carbon intensive structure of primary energy supply. Estonia also distinguishes from Baltic States with high patterns of energy consumption per capita and high-energy intensity of economy. The main reason for high primary energy intensity in Estonia is the structure of fuel balance. Oil shale constitutes the greatest share in the balance—almost 60% in 2005. Oil shale is a fuel of low calorific value (8.4 MJ/kg) and of high ash content. The major part of mined oil shale is used in power plants, where the average efficiency is low—approximately 30%. The rest of oil shale is used for production of fuel oil (shale oil). A great share (about 50% in 2005) of produced shale oil was exported. A part of electricity (13%) is exported as well. Estonia's colder climate leaves some impact on specific energy consumption too.

Lithuania and Estonia has low energy supply efficiency comparing with Latvia. The low losses in energy supply system of Latvia are caused by dominating hydro in electricity production structure. Hydro energy and imported electricity move from primary energy to final energy with 100% efficiency. Therefore, final energy consumption per GDP is the highest in Latvia though primary energy consumption per GDP is the lowest in Latvia. This gives high final energy per primary energy supply ratio in Latvia.

Verifications of GHG emission in the first trading period indicated that companies in the UK, Spain, Italy, Ireland and Austria emitted more than their cap with a total deficit of 47.4 Mt. Other countries had allocated more emission rights than actually used, 112.6 Mt in total, providing a net long position of 65.2 Mt for EU-21. Large countries like Germany and France were considerably long, 21 Mt and 19 Mt, respectively, being 4.3% and 12.7% below their caps. UK, on the other hand were 27 Mt short, corresponding to emissions being 12.6% above the cap. Across the EU, companies in the power & heat sector emitted 36 Mt CO_2 above their allowances. The main circumstances influencing emissions in this sector were abnormal dry and cold conditions in Spain and Italy, above normal precipitation in Scandinavia and record-high gas and EUA prices. Moreover, all industry sectors had surpluses, adding up to a net aggregate long position of 102 Mt for 'non-power & heat' sectors [2,5].

Analysis of results of greenhouse gas emission trading scheme implemented in Lithuania indicated that in 2005 just 3 installations from total 93 installations included in greenhouse gas emission trading scheme emitted into atmosphere more than emission allowances they have been allocated for. The similar situation was in Latvia and Estonia. Table 2 provides the results of verified GHG emissions in 2005 and 2006 for Baltic States.

As one can see from Table 2 the verified GHG emission in Estonia in 2005 and 2006 were lower than annual average allocation for 2005–2007 by 6.3 Mt and 6.9 Mt, respectively. Based on not official information on actual GHG emissions in 2007 the over-allocation in 2007 is also similar and makes about 7 Mt in Estonia. The verified GHG emissions in Lithuania in 2005 and 2006 were lower than annual average allocation in 2005–2007 by 5.7 Mt and 5.8 Mt, respectively. In 2007 GHG emissions in Lithuania should be about 6 Mt lower than annual average allocation in 2005–2007. The verified GHG emission in Estonia in 2005 and 2006 were by 1.7 Mt lower than annual average allocation in 2005–2007.

6. The implications of GHG emission trading in 2008–2012 for energy sector of Baltic States

In new National allocation plan for 2008–2012 the allowances for separate sectors and installations were allocated according to the pollution in the period of 2002–2005. However, the oneness of Lithuanian economy is related to Ignalina Nuclear Power Plant complete closure at the end of 2009, implementing the treaty of accession to the EU. The closure of Ignalina NPP will influence a much bigger load of fossil fuel fired power plants operating in Lithuania. This increase in pollution cannot be compensated by the reduction of pollution intensity. Therefore, in compliance with the experience of allowance trading system implementation in the period of 2005–2007, it has been offered in new National allocation plan for 2008–2012 to place additional allowances, allocated by evaluating the amount of additionally generated

Table 3
Verified GHG emission in 2005–2006 and proposed GHG emission cap and adopted by EC cap for 2008–2012 for Baltic States

	Emissions in 2003	Allowed cap 2005–2007	Verified emissions in 2005	Verified emissions in 2006	Surplus of EAU for 2005–2007	Proposed cap 2008–2012	Allowed cap 2008–2012
Latvia	3.7	4.6	2.9	2.9	3.6	7.7	3.3
Lithuania	7.3	12.3	6.6	6.5	14.5	16.6	8.8
Estonia	14.6	18.8	12.6	12.1	18.4	24.4	12.7

power in fossil fuel fired power plants, in the ''reserve related to the closure of Ignalina NPP'' due to the prospective closure of Ignalina NPP.

However, after the consultations with European Commission the Lithuanian National Allocation plan was adopted with these changes: the annual allocation of 8.8 Mt was accepted for Lithuania instead of 16.7 Mt asked by Lithuania therefore almost twice reduced amount was confirmed by European Commission. The total quantity is reduced by 7.7 Mt of allowances per year and these quantities are subtracted from amount allocated to additional combustion installations. Intended ex-post adjustment was eliminated and more information on new entrants was requested. The European Commission reduced requested amount of allowances for Latvia by 57%, for Lithuania by 47% and for Estonia by 47.8%. The results of approved caps of Baltic States National Allocation Plans for 2008–2012 assessed by European Commission are presented in Table 3 [3,4].

As one can see from Table 4 though European Commission has reduced significantly requested GHG emission cap for Lithuania (by 7.8 Mt) Estonia (by 11.7 Mt), Latvia (by 4.5 Mt) comparing absolute difference between verified GHG emissions in 2005 with annual average allocated GHG emissions for 2008–2012 just in Estonia their were by 0.2 Mt lower than verified GHG emission. In Lithuania the adopted annual GHG emission cap for next trading period is by 2.4 Mt higher than verified emissions in 2005 and in Latvia by 0.45 Mt higher than verified emissions. Though it seem that Lithuania even has granted over-allocation the final closure of Ignalina NPP on 2009 may cause problems as fossil fuel generating capacities would replace nuclear power plant.

It is expected that GHG emission trading will have impact on increased investments in use of renewable energy sources especially of biomass in energy sector and in increase of energy efficiency and also increase of energy prices to consumers. One of the possibilities to reduce burden on economy and to reduce EAU and energy price increase is application of flexible Kyoto mechanism which are cheaper options to acquire greenhouse gas emission credits and to cover increased greenhouse gas emissions in the country [11].

There are several criteria to assess stringency of GHG allocations for 2008–2012 and to define the possible EUA price development as well as impact on energy sector's competitiveness in this period [15,16].

Criteria 1 (ET-budget phase 1 vs. verified GHG emissions in 2005) suggests that the new total ET-budget is just below 2.7% or some 46 Mt CO_2e/a below actual emissions in 2005 (old member states (MS): −11.1% or −158.9 MtCO_2e/a; new MS: +31.3% or 112.8 Mt CO_2e/a).

Criteria 2 (ET-budget phase 2 vs. ET-budget phase 1) provides a similar picture: the 18 MS under consideration have set their ET-budgets 3% or approximately 57 million EUA p.a. below the phase 1 ET-budget (old MS: −7.7% or −122.8 mil-A p.a.; new MS: +21% or 65.7 million EUA p.a.).

Criteria 3 (ET-budget phase 2 vs. projections) shows very similar results: the phase 2 ET-budget of old MS is approximately 9.1% or 138 million EUA p.a. lower than the projection, while the new MS intend to allocate approx. 21.1% or 80.4 million EUA p.a. more than projected emissions.

The overall ET-budget of the EU MS is just 3% or 57.6 million EUA p.a. lower than projected emissions for the ET-sector. Therefore, the conclusions might be drawn that allocations in 2008–2012 will not require significant reductions, actual emissions may even be below the intended allocation. As a consequence, the price for EUAs are likely to be low [18].

Increases or reductions in costs can be used as a measure of competitiveness. Therefore, increasing costs result in falling productivity. An alternative measure is the change in output or GDP. These are an indicator of competitiveness or economic performance of companies, sectors or entire economies. The second effect of energy intensity on costs affects non-ETS participants and is based on the fact that the system could induce higher electricity prices given opportunity cost reason-

Table 4
The difference between verified GHG emission and annual GHG emission cap approved by EC for 2008–2012 for Baltic States

	Absolute reduction demanded by EC in NAPs 2008–2012 compared to NAPs submitted by MS, Mt	Absolute difference between 2005 verified emissions (including opt out and expansion of scope) and EC decision on cap 2008–2012, Mt	% reduction demanded by EC in NAPs 2008–2012 compared to NAPs submitted by MS	% difference between 2005 verified emissions (including opt out and expansion of scope) and EC decision on cap 2008–2012
Estonia	−11.66	−0.21	−47.83	−1.62
Lithuania	−7.80	2.14	−46.99	32.11
Latvia	−4.47	0.45	−57.52	15.61

ing of utilities. This refers to a special case of the general effect that for certain sectors or firms input prices may rise due to the introduction of an ETS. Such a rise of input prices is supposed to be especially relevant for electricity in the EU ETS case. The more effectively prices can be passed on, the less companies or sectors will suffer from losses of sales due to an ETS. Determining factors in this context are the price elasticity of demand and the competitive situation. The less elasticity and competition the less impact the ETS will have on sales and output [19].

The view that environmental regulation like a GHG trading scheme is merely a source of costs and thus entails competitive disadvantages for the affected firms is controversial. The key argument against this is based on what is referred to as the 'Porter hypothesis'. This hypothesis postulates that, in the long run, the objectives of environmental protection and commercial competitiveness are congruent with each other. Specifically, Porter argues that a pioneering environmental policy role can create technological first mover advantages and make companies more innovative, placing them at an advantage vis-à-vis their foreign competitors. The empirical evidence for the Porter hypothesis is mixed. Most studies tend at least to demonstrate that stricter environmental regulations do not result in a significant deterioration in competitiveness [13].

A partial equilibrium models of the energy market PRIMES, POLES, GETS 3, SIMAC s and general equilibrium models DART, GTAP-E, GTAP-ECAT were used to evaluate the impact of GHG emission trading on competitiveness of economy and other sectors [12]. The results indicated that GHG trading provides for least productivity decline and efficiency gains comparing with other GHG mitigation tools in EU. Average cost reduction is 25% by POLES and up to 50% by PRIMES. The loss of productivity because of GHG emission trading according GTAP is 0.36% or if all the sectors are studied in aggregate, the reduction in output of 0.3% is indicated by DART. Different approaches were used that are available in order to assess the impacts of the EU ETS on costs and competitiveness in Europe.

Analysis of existing simulation studies did not show the negative impact of GHG emissions trading on competitiveness of EU member states economies and power and other energy intensive sectors. The choice of the reference scenario as the most critical issue for an appropriate analysis of the relevant approaches. However, the effects of the scheme on costs and competitiveness are modest.

7. Conclusions

(1) The EU ETS has not yet delivered its real potential to reduce emissions in a cost effective way. The trading period 2005–2007 has seen an over-allocation with the EUA price collapsing as a result. For the period 2008–2012 a more stringent cap has been set but the generous access to credits from JI and CDM will again limit the emission reductions taking place within the EU.

(2) The surplus of GHG emission allowances in first trading period was probably due to a combination of two factors: (i) generous allocation and (ii) internal abatement and efficiency improvements. The first is by far the most important.

(3) The verified GHG emission in Estonia in 2005 and 2006 were lower than annual average allocation for 2005–2007 by 6.3 Mt and 6.9 Mt, respectively. Based on not official information on actual GHG emissions in 2007 the over-allocation in 2007 is also similar and makes about 7 Mt in Estonia. The verified GHG emissions in Lithuania in 2005 and 2006 were lower than annual average allocation in 2005–2007 by 5.7 Mt and 5.8 Mt, respectively. In 2007 GHG emissions in Lithuania were about 6 Mt lower than annual average allocation in 2005–2007. The verified GHG emission in Estonia in 2005 and 2006 were by 1.7 Mt lower than annual average allocation in 2005–2007.

(4) Assessments of the stringency of the ET-budgets for 2008–2012 suggest that the intended allocation for the ET-sector in 2008–2012 will not require significant reductions – given the error of margin on the data – actual emissions may – similar to phase 1 of the ETS – even be well below the intended allocation.

(5) EU target for 2020 is to reduce GHG emissions by 20% comparing with year 1990 level. However, there are opinions that new member states should take more stringent caps in burden sharing agreement. Though according GHG emission projections according "with measures" scenario Baltic States will be able to implement this target some circumstance of Baltic States energy sector should be taken into account.

(6) Baltic States could face energy shortages if very strict caps on GHG emissions will be imposed after 2012. As Baltic States heavily reliant on fossil fuels, the too tight a cap on GHG emissions could mean lowered electricity generation and Baltic countries have little opportunity to import electricity from other countries, due to a lack of transmission lines. The planned closure of the INPP in Lithuania, which supplies 80% of that country's electricity, means that the country also faces rising emissions from fossil-fuelled power plants. The decision on how much each country should contribute to the EU cap should take into account that 90% of Estonia's CO_2 emissions come from the burning of oil shale. The Latvian situation is the least problematic.

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